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Health Equity Within Inequity: Timing of Diagnostic Breast Cancer Care in an Underserved Medical Population

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Abstract. *Background/Aim: We evaluated timeliness of care at a safety-net hospital after implementation of a multidisciplinary breast program. Patients and Methods: A prospective database of patients with breast cancer was created after multidisciplinary breast program initiation in 2018. Patients were tracked to obtain time to completion of diagnostic imaging, biopsy, and treatment initiation. Patients with breast cancer diagnosed from 2015-2017 were reviewed for comparison. Results: A total of 102 patients were identified. There was no statistical difference in time to completion of imaging, biopsy, and initial treatment between the 2018 and the 2015-2017 cohorts (p>0.05). No statistical difference was observed in time to completion of imaging, biopsy, and initial treatment between different races (p>0.05). Conclusion: Within the same socioeconomic status, there was no differential delivery of screening, work-up, and treatment by race. Despite protocol implementations, efficiency of care remained limited in a safety-net hospital with lack of financial resources.*

Despite advances in breast cancer screening and treatment which has improved overall survival, women of lower socioeconomic status continue to have higher morbidity and mortality (1). Non-Hispanic Black women continue to experience as high as 39% increased rates of breast cancer mortality when compared to their non-Hispanic White counterparts (1, 2). In addition to race, presentation at an advanced stage and aggressive tumor biology are strongly associated with lower socioeconomic factors as reflected by Medicaid or absence of health insurance (3). These trends have been present since 1981 and persist today (2, 4, 5).

Current literature has identified a multitude of etiologies, including lack of access, inferior treatment, lower socioeconomic status, insurance status, and linguistic barriers, contributing to the inequality of care and patient outcomes (6-8). Institutionalized racism may also play a role due to structural and differential access to services, resources, and treatment which may limit and restrict access of appropriate socioeconomic resources to minorities (9). Accessibility and changes to mammographic screening have been identified as modifiable tools to reduce breast cancer disparities (10). However, few studies have prospectively evaluated implementation of mammographic screening protocols and its effects on mammographic screening rates, timing of diagnostic work up, and treatment in underserved communities.

To better delineate patient, provider and healthcare system factors that contribute to these disparities, a prospective database of screening mammography was initiated at an urban medical safety-net hospital caring for an underserved medical population. Our aim was to evaluate the timeliness of care at a safety-net hospital after implementation of a multidisciplinary breast program and mammographic database. As a first step to efficiency, we also evaluated how patients were diagnosed – via screening mammography or diagnostic mammography – and the stage distribution for each modality.

Patients and Methods

In an effort to elucidate the various patient, provider and healthcare system factors that contribute to disparities at our urban medical center serving an underserved patient population, we developed a prospective mammography database with Institutional Review Board approval (IRB# 19009252B) at Alameda Health System. Our

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Institution is a safety-net county hospital serving uninsured and underinsured patients in a diverse community in Alameda County, California. Satellite community offices staffed with primary care providers and obstetrician-gynecologists obtained mammography per screening guidelines at the individual sites.

In 2018, we developed a more cohesive multidisciplinary breast program with set algorithms to improve patient experience and throughput at our urban medical center. Protocol implementation included co-locating the Breast and Oncology Clinics and creation of a weekly Tumor Board between breast surgeons and oncologists to review patients with breast cancer.

We identified all patients who had screening and diagnostic mammograms completed in 2015-2018. All patients with a pathological diagnosis of ductal carcinoma *in situ* or invasive breast cancer were tracked prospectively from 2018. In order to understand trends over time, we retrospectively reviewed patients who were diagnosed with breast cancer from 2015-2017. Demographic data collected from electronic medical records included age at biopsy, race, and the type of insurance. Clinical data included clinical stage and pathology results. Primary outcomes were time to completion of diagnostic studies, time from completion of diagnostic imaging to biopsy, and time from biopsy to initiation of treatment. Time to completion of diagnostic imaging was defined as the time from screening mammogram to diagnostic mammogram/ultrasound. If patients had presented with clinical findings, the time to the completion of diagnostic imaging was included if the patient required additional imaging from initial diagnostic imaging. Time to initiation of treatment was defined as the time from biopsy to either neoadjuvant chemotherapy or surgery. Secondary endpoints included evaluation of false-positive (FP) rates of screening mammograms at our safety-net hospital system. Due to loss to follow-up and inconsistent surveillance in our population of underserved patients, it was not possible to obtain the number of true negatives. Thus, the FP rate was calculated as the number of FPs as a proportion of the total number of screening mammograms.

Descriptive statistics were used to report the distributions of the demographics, clinical characteristics, and outcome variables using the median and interquartile range (IQR) for continuous variables and frequencies and percentages for categorical variables. Comparison between 2018 and the 2015-2017 cohorts was analyzed using Pearson's chi-square or Fischer's exact tests for categorical variables and Wilcoxon rank-sum test for continuous variables. When describing all patients in the study, differences between outcomes of racial groups were analyzed using Fisher's exact test for categorical variables and analysis of variance for continuous variables. All *p*-values were from two-sided tests and results were considered significant at $p<0.05$. All statistical analyses were performed using IBM SPSS® Statistics (version 27.0; Armonk, NY, USA).

Results

Our search yielded 102 patients diagnosed with breast cancer between 2015- 2018. Seventy-six patients were diagnosed between 2015-2017; the remaining 26 patients were diagnosed in 2018. Of the 2018 cohort, only 42% (n=11) were diagnosed based on a screening mammogram; the remaining 58% (n=15) presented with clinical symptoms such as breast mass, breast pain, or nipple discharge. Among the patients diagnosed and treated in 2015-2017, only 27 cases of cancer (36%) were screen-detected while 49 patients (64%) presented with clinical signs and symptoms necessitating a diagnostic workup (Figure 1). The pre-protocol and post-protocol cohorts were similar in cancer detection method ($p=0.54$). Table I shows the characteristics of patients whose cancer was screen-detected and Table II shows characteristics of patients whose disease was clinically detected. A higher percentage of patients with stage 0 and stage 1 breast cancer were detected by screening than clinically (stage 0: 13% *vs*. 1%, $p=0.02$; stage 1: 62% *vs*. 22%, $p<0.01$). No stage 4 breast cancers were screen-detected (Figure 2). There was no statistically significant difference between racial groups and stage of presentation ($p=0.18$).

Overall, the median time to completion of diagnostic imaging was 22 days (IQR=22 days). The median time from imaging to biopsy was 29 days (IQR=29 days). The median time from biopsy to treatment was 30 days (IQR=24 days). There was no statistically significant difference in time to completion of imaging, time to biopsy, and time to initial treatment between the 2018 and the 2015-2017 cohorts. The median time between initial imaging and completion of diagnostic imaging was 24.5 days (IQR=23 days) for the 2018 cohort *vs*. 22.0 days (IQR=26 days) for the 2015-2017 cohort, respectively ($p=0.45$). The median time between completion of diagnostic imaging and biopsy was 22 days (IQR=20 days) for the 2018 cohort and 33 days (IQR=32 days) for the 2015-2017 cohort ($p=0.96$). The median time between pathological diagnosis and the initiation of any treatment (local or systemic) was 36 days (IQR=21 days) for the 2018 cohort *vs*. 28 days (IQR=23 days) for the 2015-2017 cohort ($p=0.62$) (Table III). When evaluating all patients, there was no significant difference in time to completion of imaging, time to biopsy, and time to initial treatment between different racial groups ($p=0.09$, $p=0.08$ and $p=0.49$, respectively).

A total of 1,732 screening mammograms were completed between 2015 and 2018. The overall FP rate was 4.8%. Individual FP rates by year are shown in Table IV and varied significantly by year ($p=0.03$).

Discussion

In our retrospective cohort study, after implementation of a multidisciplinary breast program and mammographic database, there was no change in timeliness of breast cancer treatment for patients at our safety-net hospital. There were no statistically significant differences in stage at diagnosis and timing of breast cancer workup or treatment between different racial groups. Although protocols were established and patients had equitable care, patients at our safety-net hospital continued to experience prolonged times for workup and treatment compared to other settings with more economic resources (11).

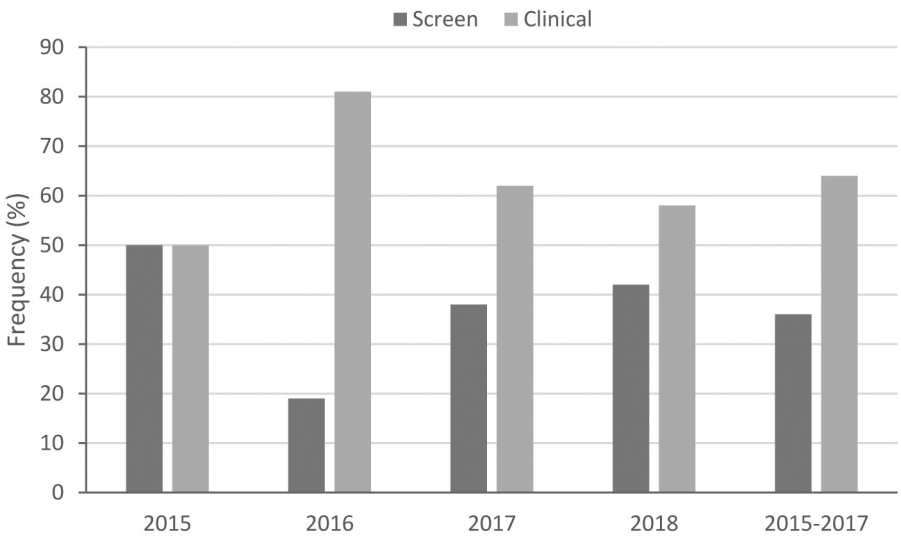

Figure 1. *Comparison of the percentage of screen- and clinically detected breast cancer by year.*

Table I. *Demographic characteristics of patients with screen-detected cancer by year.*

Characteristic		2015 (N=4)	2016 (N=6)	2017 (N=18)	2018 (N=11)	*p*-Value
Age at biopsy, years	Median (IQR)	59 (7.8)	60.5 (6.3)	66.6 (12.0)	59 (17.5)	0.740
Age at biopsy, n (%)	<50 Years	0 (0%)	1 (17%)	2 (11%)	4 (36%)	0.097
	50-64 Years	3 (75%)	5 (83%)	10 (56%)	2 (18%)	
	≥65 Years	1 (25%)	0 (0%)	6 (33%)	5 (46%)	
Race, n (%)	Asian	0 (0%)	0 (0%)	4 (22%)	3 (27%)	0.682
	Hispanic	3 (75%)	4 (67%)	6 (33%)	6 (55%)	
	Caucasian	0 (0%)	1 (17%)	2 (11%)	0 (0%)	
	African American	1 (25%)	1 (17%)	6 (33%)	2 (18%)	
	Other	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Clinical stage, n (%)	0	1 (25%)	0 (0%)	2 (11%)	2 (18%)	0.589
	1	1 (25%)	5 (83%)	12 (67%)	6 (55%)	
	2	2 (50%)	1 (17%)	4 (22%)	2 (18%)	
	3	0 (0%)	0 (0%)	0 (0%)	1 (9%)	
	4	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

IQR: Interquartile range.

Delays or incomplete diagnostic evaluations and treatment after an imaging cancer-related abnormality is discovered are worse for African-American and Hispanic patients in comparison to non-Hispanic Caucasians (12). Our data show that time to treatment extended to over a month. Previous studies have also noted similar time frames of greater than 1 month of delay in treatment of African-Americans when compared to non-Hispanic Caucasians (13, 14). Interestingly, in our study, all patients, regardless of race, received equitable care. There were no differences in timing of diagnostic work up and treatment between ethnic minorities, such as Black and Hispanic patients, and White patients. However, our patients overall experienced an increase in time of diagnostic work up and treatment compared to patient populations of higher socioeconomic status (11). Delays in care ultimately lead to a decrease in survival (15). By effectively targeting each interval during the diagnostic and treatment process, it is predicted that the time from diagnosis to initiation of treatment will likely improve as well. Although some quality improvement measures were initiated at our Institution, these were not sufficient to result in improvement in the timeliness of breast cancer care. This highlights the importance of resources and interventions needed at each and every interval of breast cancer care and,

Table II. *Demographic characteristics of patients with clinically detected cancer by year.*

Characteristic		2015 (N=6)	2016 (N=18)	2017 (N=24)	2018 (N=15)	*p*-Value
Age at biopsy, years	Median (IQR)	47 (5)	58.5 (13)	56 (8)	58 (22)	0.924
Age at biopsy, n (%)	<50 Years	4 (67%)	3 (17%)	5 (21%)	6 (40%)	0.110
	50-64 Years	1 (17%)	9 (50%)	15 (63%)	4 (27%)	
	≥65 Years	1 (17%)	6 (33%)	4 (17%)	5 (33%)	
Race, n (%)	Asian	3 (50%)	1 (6%)	5 (21%)	5 (33%)	0.150
	Hispanic	0 (0%)	4 (22%)	9 (38%)	2 (13%)	
	Caucasian	0 (0%)	2 (10%)	4 (17%)	1 (7%)	
	African American	3 (50%)	10 (56%)	5 (21%)	7 (47%)	
	Other	0 (0%)	1 (6%)	1 (4%)	0 (0%)	
Clinical stage, n (%)	0	0 (0%)	0 (0%)	1 (4%)	0 (0%)	0.879
	1	2 (33%)	6 (33%)	10 (42%)	4 (27%)	
	2	3 (50%)	7 (39%)	9 (38%)	5 (33%)	
	3	1 (17%)	1 (6%)	2 (8%)	2 (13%)	
	4	0 (0%)	4 (22%)	2 (8%)	4 (27%)	

IQR: Interquartile range.

ultimately, the necessity of funding needed to change the infrastructure in order to improve breast cancer care for patients of low socioeconomic status.

Based upon our data, screening and early detection continue to be an issue in underserved communities. Rates of presentation of breast cancer by palpable detection in the United States have been cited as 43% in 2000, reaching 34.6% in 2006, falling to 28.9% in 2010 (16, 17). In contrast, in our underserved community hospital population, in the majority of patients, breast cancer was detected via clinical symptoms rather than screening, at a rate of 68%. It is noteworthy that such a small percentage of breast cancers at our institution were screen-detected rather than clinically detected, which is consistent with other safety-net institutions in the United States and with patterns of presentation of patients with breast cancer in low- and middle-income countries (18, 19). This in part may be due to reduced access to screening (20), and the fact that Non-Hispanic Black and Hispanics are more likely than non-Hispanic White patients to have interval cancer despite a recent screening mammogram (21). Additionally, ductal carcinoma *in situ* was a relatively uncommon diagnosis at our Institution. This reiterates that regular screening for breast cancer, while uniformly recommended per United States Preventive Task Force and American Cancer Society guidelines, is not equally distributed across all segments of the population and therefore a universal screening model should be revisited with consideration of racial and socioeconomic status (22). Our study further illuminates the issue that despite advancement in mammography and public awareness of recommendations, disparities continue to exist in low-income and underserved communities. Access to care remains an issue as reflected by recent studies that show that insurance differences account for one-third of deaths in Black women with breast cancer (23).

In our study, there was no improvement in the time to completion of diagnostic imaging, time from diagnostic imaging to biopsy, and time from pathological diagnosis to initiation of treatment. For time to biopsy, barriers at our Institution included the need for healthcare providers to place biopsy orders after review of positive imaging results in addition to issues with approval by insurance companies. This highlights an issue that we did not initially anticipate. To expedite this process, we proposed a change in protocols to have biopsies completed at the time of diagnostic mammogram for patients with lesions of Breast Imaging-Reporting and Data System categories 4 or 5. In addition, an improved multidisciplinary program was initiated during the beginning of 2018 to improve the time from pathological diagnosis to the initiation of treatment. However, no improvement was noted. This may be secondary to the initiation of new protocols that require time for implementation, as well as adjustments, before subsequent effects are seen. Longer term data may reflect more effective changes.

In our population, our FP rate was 4.8%, which is lower than the average rate of 6-10% in the United States (24). In contrast, a large retrospective study which evaluated 168,251 mammograms found that facilities serving vulnerable women had higher FP rates than those serving nonvulnerable women (25). One reason for this may be that our facilities are not completing enough screening mammograms for our patient population. Higher screening frequencies are associated with higher cumulative FP risk for a patient (26). This suggests that more interventions at the provider and patient level within a healthcare system serving a low socioeconomic population is needed to increase adherence to mammographic screening guidelines.

Our results highlighted issues in breast cancer care within our safety-net hospital and was brought to the hospital

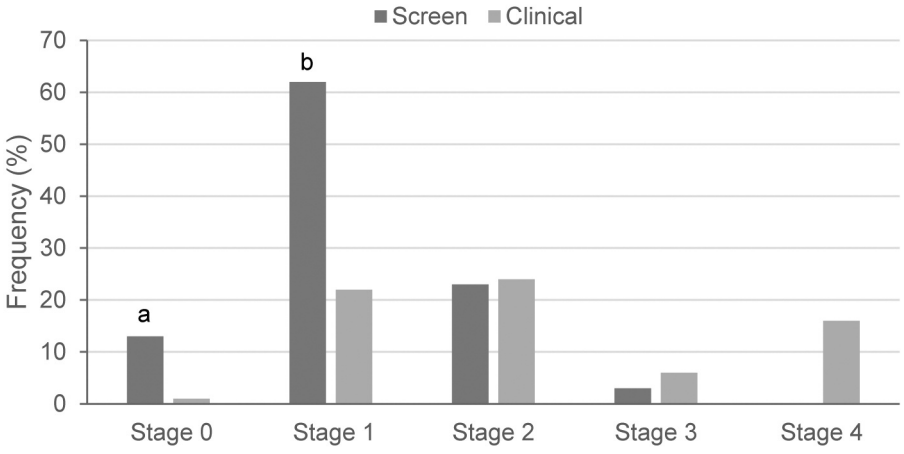

Figure 2. *Comparison of the percentage of screen- and clinically detected cancer by clinical stage. Significantly different at: [a]p=0.02, [b]p<0.01.*

Table III. *Comparison of the median time (interquartile range) during diagnosis and treatment (defined as initiation of neoadjuvant chemotherapy or surgery) course by year and by pre- and post-protocol cohort.*

Duration, days	2015 (N=8)	2016 (N=26)	2017 (N=42)	2018 (N=26)	2015-2017 (N=76)	*p*-Value	
						By year	By cohort
Screening to completion of diagnostic imaging	27.0 (63)	33.5 (36)	19.5 (16)	24.5 (23)	22.0 (26)	0.449	0.476
Completion of diagnostic imaging to biopsy	46.0 (34)	42 (30)	26.0 (21)	22.0 (20)	33.0 (32)	0.962	0.862
Diagnosis to treatment	41.0 (38)	36.0 (32)	25.5 (14)	36.0 (21)	28.0 (23)	0.622	0.412

Table IV. *Distribution of cancer diagnoses and false-positive rates of screening mammograms by year.*

Diagnosis	2015 (N=177)	2016 (N=461)	2017 (N=610)	2018 (N=484)
Cancer, n (%)	5 (2.9%)	10 (2.2%)	22 (3.6%)	15 (3.1%)
DCIS	1 (0.6%)	3 (0.7%)	1 (0.2%)	5 (1%)
Invasive	4 (2.3%)	7 (1.5%)	21 (3.4%)	10 (2.1%)
False-positive, n (%)	6 (3.4%)	28 (6.1%)	37 (6.1%)	13 (2.7%)

DCIS: Ductal carcinoma *in situ*.

leadership's attention in order to provide adequate resources to improve the time to biopsy. This has subsequently led to an ongoing quality improvement project that has been initiated to shorten the median time from completion of imaging to biopsy from 29 days to 1 week. Our Institution was recently awarded a grant to reduce the time from an abnormal mammogram to biopsy consistent with the goals of minimizing racial disparities in cancer care, with dedicated physician time to tackle the problem highlighted by this study. The process is being deconstructed with recommendations made by the administration to increase the efficiency of the process. Achieving improvement in health outcomes ultimately requires a prospective quality improvement approach but this study thoughtfully highlights the nature of the problem such that it was possible to initiate the process of a solution.

The main limitation of our study was that data were obtained retrospectively at a single collective institution without randomization. Secondly, the total number of patients included in this study was small, with variability by year, and

may not be powered for statistical significance. Finally, the initial years had fewer data points during the initiation of the program and mammographic screening protocols, which may be secondary to the transition and implementation of a new electronic health record as well as improved databases.

We propose that future prospective studies establish protocols in order to expedite and reduce temporal delays during a patient's course, whether clinically or screen-detected, from first contact until treatment. This is now an ongoing major goal of our Institution. Reducing delays at underserved communities will reduce morbidity and mortality of minority and low-income patients with breast cancer (27, 28). Additional studies would include collecting more prospective data to evaluate implementation of adjuncts such as a clinical coordinator, multidisciplinary meetings, streamlining authorization, radiographic orders, and referrals to evaluate outcomes in patient care. Resources and interventions are needed during the entire care of patients of a low socioeconomic background in order to overcome the disparities seen in breast cancer. At the same time, investment in quality improvement specifically targeted at underserved patient populations is likely to achieve a higher return on investment than small incremental changes in wealthier patient populations – indicating that cancer health economics remains a zero-sum game with an asset allocation problem.

In summary, establishing screening protocols and a multidisciplinary breast program at a safety-net hospital with limited economic resources did not improve the time to completion of diagnostic imaging, time from diagnostic imaging to biopsy, nor time from pathological diagnosis to initiation of treatment. Within the same socioeconomic status, there was no differential delivery of screening, work-up, or treatment for breast cancer. Our study identified multiple time periods after screening as limiting factors during the screening and treatment process for our patient population, including time to biopsy as well as initiation of treatment. If the time between diagnostic imaging and biopsy can be reduced, it would result in quicker medical and surgical treatment, potentially leading to improved survival (27, 28). Future protocols aimed at specific interventions within each provider and system level is prudent to improve access and efficiency of breast cancer treatment and reduce disparities for patients in underserved communities.

Conflicts of Interest

The Authors have no conflicts of interest to declare regarding this study.

Authors' Contributions

ALK and KBK conceived and designed this study. AT and ALK analyzed the data. AT wrote the draft. All Authors participated in acquisition of data, interpretation of data, made critical revisions, and approved the final version of the article.

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References

1 Ghafoor A, Jemal A, Ward E, Cokkinides V, Smith R and Thun M: Trends in breast cancer by race and ethnicity. CA Cancer J Clin *53(6)*: 342-355, 2003. PMID: 15224974. DOI: 10.3322/canjclin.53.6.342

2 DeSantis CE, Ma J, Goding Sauer A, Newman LA and Jemal A: Breast cancer statistics, 2017, racial disparity in mortality by state. CA Cancer J Clin *67(6)*: 439-448, 2017. PMID: 28972651. DOI: 10.3322/caac.21412

3 Samiian L, Sharma P, Van Den Bruele AB, Smotherman C, Vincent M and Crandall M: The effect of insurance and race on breast cancer tumor biology and short-term outcomes. Am Surg *84(7)*: 1223-1228, 2018. PMID: 30064593.

4 Wells BL and Horm JW: Stage at diagnosis in breast cancer: race and socioeconomic factors. Am J Public Health *82(10)*: 1383-1385, 1992. PMID: 1415866. DOI: 10.2105/ajph.82.10.1383

5 Chen VW, Correa P, Kurman RJ, Wu XC, Eley JW, Austin D, Muss H, Hunter CP, Redmond C and Sobhan M: Histological characteristics of breast carcinoma in blacks and whites. Cancer Epidemiol Biomarkers Prev *3(2)*: 127-135, 1994. PMID: 7519506.

6 Eley JW, Hill HA, Chen VW, Austin DF, Wesley MN, Muss HB, Greenberg RS, Coates RJ, Correa P and Redmond CK: Racial differences in survival from breast cancer. Results of the National Cancer Institute Black/White Cancer Survival Study. JAMA *272(12)*: 947-954, 1994. PMID: 8084062. DOI: 10.1001/jama.272.12.947

7 Krieger N, van den Eeden SK, Zava D and Okamoto A: Race/ethnicity, social class, and prevalence of breast cancer prognostic biomarkers: a study of white, black and Asian women in the San Francisco bay area. Ethn Dis *7(2)*: 137-149, 1997. PMID: 9386954.

8 Roetzheim RG, Gonzalez EC, Ferrante JM, Pal N, Van Durme DJ and Krischer JP: Effects of health insurance and race on breast carcinoma treatments and outcomes. Cancer *89(11)*: 2202-2213, 2000. PMID: 11147590. DOI: 10.1002/1097-0142(20001201)89:11<2202::aid-cncr8>3.0.co;2-l

9 Feagin J and Bennefield Z: Systemic racism and U.S. health care. Soc Sci Med *103*: 7-14, 2014. PMID: 24507906. DOI: 10.1016/j.socscimed.2013.09.006

10 Hiatt RA, Pasick RJ, Stewart S, Bloom J, Davis P, Gardiner P, Johnston M, Luce J, Schorr K, Brunner W and Stroud F: Community-based cancer screening for underserved women: design and baseline findings from the Breast and Cervical Cancer Intervention Study. Prev Med *33(3)*: 190-203, 2001. PMID: 11522160. DOI: 10.1006/pmed.2001.0871

11 Doubeni CA, Gabler NB, Wheeler CM, McCarthy AM, Castle PE, Halm EA, Schnall MD, Skinner CS, Tosteson ANA, Weaver DL, Vachani A, Mehta SJ, Rendle KA, Fedewa SA, Corley DA and Armstrong K: Timely follow-up of positive cancer screening

results: A systematic review and recommendations from the PROSPR Consortium. CA Cancer J Clin *68(3)*: 199-216, 2018. PMID: 29603147. DOI: 10.3322/caac.21452

12 Fedewa SA, Edge SB, Stewart AK, Halpern MT, Marlow NM and Ward EM: Race and ethnicity are associated with delays in breast cancer treatment (2003-2006). J Health Care Poor Underserved *22(1)*: 128-141, 2011. PMID: 21317511. DOI: 10.1353/hpu.2011.0006

13 Gwyn K, Bondy ML, Cohen DS, Lund MJ, Liff JM, Flagg EW, Brinton LA, Eley JW and Coates RJ: Racial differences in diagnosis, treatment, and clinical delays in a population-based study of patients with newly diagnosed breast carcinoma. Cancer *100(8)*: 1595-1604, 2004. PMID: 15073845. DOI: 10.1002/cncr.20169

14 Gorin SS, Heck JE, Cheng B and Smith SJ: Delays in breast cancer diagnosis and treatment by racial/ethnic group. Arch Intern Med *166(20)*: 2244-2252, 2006. PMID: 17101943. DOI: 10.1001/archinte.166.20.2244

15 Jemal A, Robbins AS, Lin CC, Flanders WD, DeSantis CE, Ward EM and Freedman RA: Factors that contributed to black-white disparities in survival among nonelderly women with breast cancer between 2004 and 2013. J Clin Oncol *36(1)*: 14-24, 2018. PMID: 29035645. DOI: 10.1200/JCO.2017.73.7932

16 Caughran J, Braun TM, Breslin TM, Smith DR, Kreinbrink JL, Parish GK, Davis AT, Bacon-Baguley TA, Silver SM and Henry NL: The Effect of the 2009 USPSTF breast cancer screening recommendations on breast cancer in Michigan: A longitudinal study. Breast J *24(5)*: 730-737, 2018. PMID: 29785764. DOI: 10.1111/tbj.13034

17 Mathis KL, Hoskin TL, Boughey JC, Crownhart BS, Brandt KR, Vachon CM, Grant CS and Degnim AC: Palpable presentation of breast cancer persists in the era of screening mammography. J Am Coll Surg *210(3)*: 314-318, 2010. PMID: 20193894. DOI: 10.1016/j.jamcollsurg.2009.12.003

18 Shavers VL, Harlan LC and Stevens JL: Racial/ethnic variation in clinical presentation, treatment, and survival among breast cancer patients under age 35. Cancer *97(1)*: 134-147, 2003. PMID: 12491515. DOI: 10.1002/cncr.11051

19 Dehal A, Abbas A and Johna S: Racial disparities in clinical presentation, surgical treatment and in-hospital outcomes of women with breast cancer: analysis of nationwide inpatient sample database. Breast Cancer Res Treat *139(2)*: 561-569, 2013. PMID: 23690143. DOI: 10.1007/s10549-013-2567-1

20 Blendon RJ, Aiken LH, Freeman HE and Corey CR: Access to medical care for black and white Americans. A matter of continuing concern. JAMA *261(2)*: 278-281, 1989. PMID: 2909026.

21 Mortel M, Rauscher GH, Murphy AM, Hoskins K and Warnecke RB: Racial and ethnic disparity in symptomatic breast cancer awareness despite a recent screen: The role of tumor biology and mammography facility characteristics. Cancer Epidemiol Biomarkers Prev *24(10)*: 1599-1606, 2015. PMID: 26199340. DOI: 10.1158/1055-9965.EPI-15-0305

22 Benavidez GA, Zgodic A, Zahnd WE and Eberth JM: Disparities in meeting USPSTF breast, cervical and colorectal cancer screening guidelines among women in the United States. Prev Chronic Dis *18*: E37, 2021. PMID: 33856975. DOI: 10.5888/pcd18.200315

23 Ward E, Halpern M, Schrag N, Cokkinides V, DeSantis C, Bandi P, Siegel R, Stewart A and Jemal A: Association of insurance with cancer care utilization and outcomes. CA Cancer J Clin *58(1)*: 9-31, 2008. PMID: 18096863. DOI: 10.3322/CA.2007.0011

24 Le MT, Mothersill CE, Seymour CB and McNeill FE: Is the false-positive rate in mammography in North America too high? Br J Radiol *89(1065)*: 20160045, 2016. PMID: 27187600. DOI: 10.1259/bjr.20160045

25 Goldman LE, Walker R, Miglioretti DL, Smith-Bindman R, Kerlikowske K and National Cancer Institute Breast Cancer Surveillance Consortium: Accuracy of diagnostic mammography at facilities serving vulnerable women. Med Care *49(1)*: 67-75, 2011. PMID: 20966780. DOI: 10.1097/MLR.0b013e3181f380e0

26 Christiansen CL, Wang F, Barton MB, Kreuter W, Elmore JG, Gelfand AE and Fletcher SW: Predicting the cumulative risk of false-positive mammograms. J Natl Cancer Inst *92(20)*: 1657-1666, 2000. PMID: 11036111. DOI: 10.1093/jnci/92.20.1657

27 Richards MA, Westcombe AM, Love SB, Littlejohns P and Ramirez AJ: Influence of delay on survival in patients with breast cancer: a systematic review. Lancet *353(9159)*: 1119-1126, 1999. PMID: 10209974. DOI: 10.1016/s0140-6736(99)02143-1

28 Yung R, Ray RM, Roth J, Johnson L, Warnick G, Anderson GL, Kroenke CH, Chlebowski RT, Simon MS, Fung C, Pan K, Wang D, Barrington WE and Reding KW: The association of delay in curative intent treatment with survival among breast cancer patients: findings from the Women's Health Initiative. Breast Cancer Res Treat *180(3)*: 747-757, 2020. PMID: 32062784. DOI: 10.1007/s10549-020-05572-y

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